

# (12) UK Patent Application (19) GB (11) 2 030 275 A

- (21) Application No 7930321  
(22) Date of filing 31 Aug 1979  
(23) Claims filed 31 Aug 1979  
(30) Priority data  
(31) 783018  
(32) 4 Sep 1978  
(33) Norway (NO)  
(43) Application published  
2 Apr 1980  
(51) INT CL<sup>3</sup>  
F23G 5/00 F23C 11/02  
(52) Domestic classification  
F4B A17  
(56) Documents cited  
GB 1476992  
GB 1450807  
GB 1448198  
GB 1173955  
(58) Field of search  
F4B  
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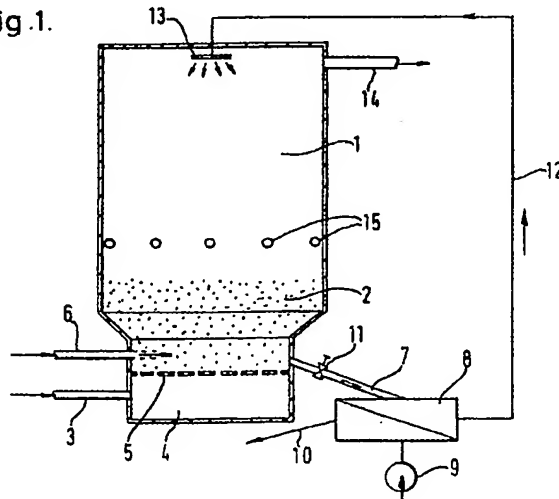
## (54) Fluidised bed incinerator

(57) There is provided a method and an apparatus for the operation of a fluidized-bed incinerator wherein a portion of the fluidized-bed medium (2) of the furnace is caused to pass a heat exchanger (8) during tapping from the combustion chamber of the furnace, and after cooling in the heat exchanger (8) is returned to the fluidized bed in the combustion chamber. The cooled fluidized-bed medium may be returned directly to

the fluidized bed in the combustion chamber or it may be returned to the combustion chamber in an upper portion thereof and be allowed to fall through a distributor (13) so that it cools the zone above the fluidized bed at the same time as the medium is heated by waste gases from the combustion. The tapping of fluidized-bed medium is preferably controlled by a thermostat sensing the temperature of the fluidized bed.

In an alternative arrangement the heat exchanger may be within a lower part of the fluidized bed.

Fig. 1.



The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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Fig. 1.

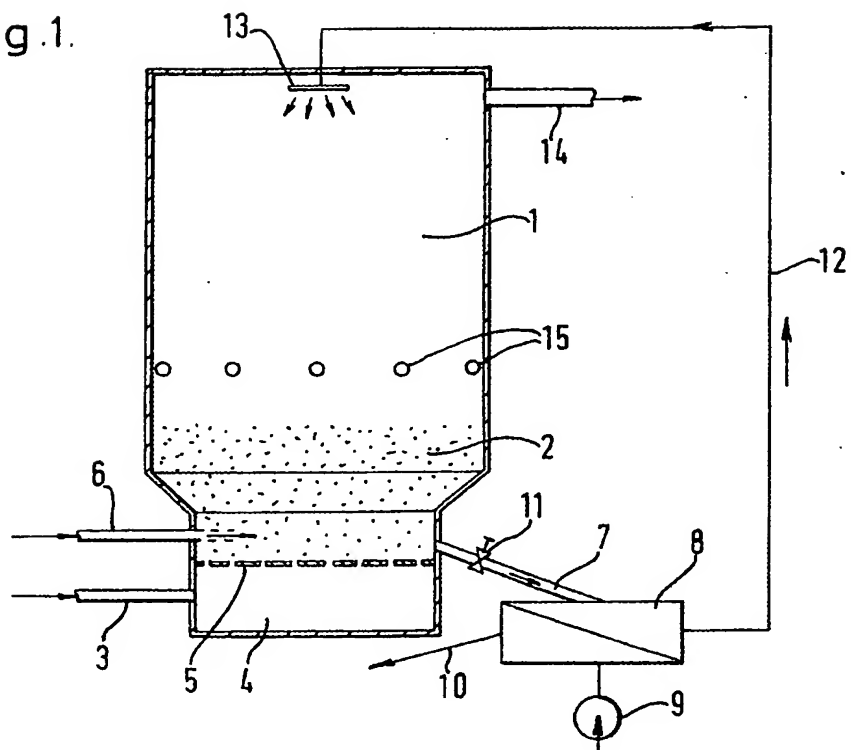
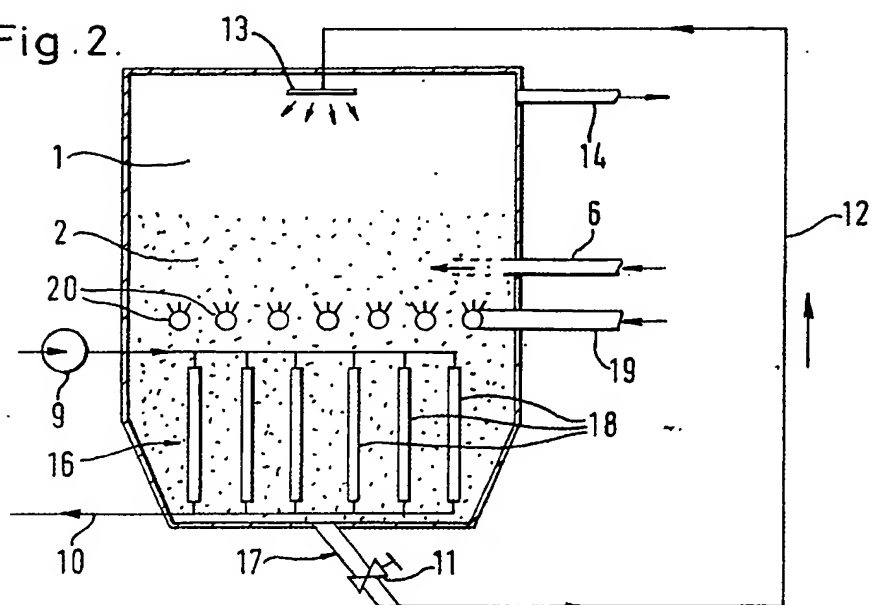


Fig. 2.



## SPECIFICATION

**Method of operating a fluidised-bed incinerator, and means for carrying out the method**

5 The present invention relates to a method of operating a fluidized-bed incinerator having a combustion chamber containing fluidized-bed medium which is heated during combustion of fuel in the combustion chamber. Further, the invention  
10 relates to an apparatus for the operation of a fluidized-bed incinerator in accordance with the method, wherein the fluidized-bed incinerator comprises a combustion chamber with a fluidized-bed medium contained therein.

15 In a fluidized-bed incinerator, fuel, e.g. garbage, is fed to the combustion chamber of the furnace wherein the fuel is mixed with a carrying medium, such as sand, which is fluidized e.g. by means of blown-in air.

20 The combustion or burning of the fuel essentially takes place in the fluidized bed during heating by means of the carrying medium.

The heat quantity given off to the air and the exhaust gases is conducted away with the  
25 air/exhaust gases by way of an exhaust outlet and may be utilized for the operation of steam boilers etc. Further, it is known to arrange heat exchanger tubes in the lower part of the combustion chamber, which tubes are surrounded by said  
30 heated carrying medium, whereby this medium gives off its heat to the tubes.

During operation said heat exchanger tubes become very warm and in this condition they are influenced mechanically by the whirling sand,  
35 which results in a very short lifetime for the tubes.

Further, the exhaust gases of such an incinerator are also very warm and necessitate relatively large boilers for utilization of the heat content of the exhaust gases.

40 The object of the invention is to provide a method and an apparatus whereby the above mentioned drawbacks to a great extent are eliminated as a result of the fact that the temperature of the fluidized bed may be held at a  
45 suitable value and further the temperature in the zone above the fluidized bed and thus the exhaust gas temperature may be reduced.

According to the invention the above mentioned object is achieved by the method set forth above in that a portion of the fluidized-bed  
50 medium is caused to pass a heat exchanger during tapping from the combustion chamber, and after cooling in the heat exchanger is returned to the fluidized bed of the combustion chamber.

55 For carrying out the method according to the invention there is provided an apparatus of the type set forth above which, according to the invention, is characterized in that it comprises a means for tapping of fluidized-bed medium from  
60 the combustion chamber, a heat exchanger arranged to be supplied with fluidized-bed medium during tapping from the combustion chamber, and a means for transferring medium from the heat exchanger to the combustion

65 chamber.

By means of the present method, wherein warm fluidized-bed medium is cooled in a separate heat exchanger and is thereafter conveyed back to the fluidized bed in the  
70 combustion chamber, the bed temperature may be held down at a suitable value. The tapping or discharge of the medium may advantageously be controlled by means of a thermostat, so that the fluidized bed may be kept at a predetermined,  
75 appropriate temperature. When the fluidized bed medium (usually sand) is returned to an upper portion of the combustion chamber, this contributes to lowering the temperature in the zone above the fluidized bed. The sand is heated  
80 and the bed is supplied with heat from the sand falling down through the hot exhaust or waste gases from the combustion. The point of introducing the sand into the combustion chamber may be placed where it is found to be most  
85 suitable with respect to the fuel in question.

The invention will be more closely described below in connection with exemplary embodiments with reference to the accompanying drawing, wherein

90 Fig. 1 shows a schematical longitudinal section of a fluidized-bed incinerator with a heat exchanger arranged externally thereto; and

Fig. 2 shows a similar schematic longitudinal section with an alternative heat exchanger  
95 arrangement.

The fluidized-bed incinerator shown in Fig. 1 comprises a reactor or combustion chamber 1 which is partly filled with a granular (or the like) medium 2, e.g. sand. Air is supplied through an  
100 inlet 3 to an air box 4 arranged beneath the combustion chamber 1 of the furnace and having a roof 5 in the form of a so-called "nozzle plate" forming the bottom of the combustion chamber 1 and being provided with perforations, so that the supplied air is blown upwards into the combustion  
105 chamber 1 through said perforations and fluidizes the sand.

Fuel is supplied to the furnace by way of a suitable feeding means 6, e.g. a worm conveyor, which debouches into the combustion chamber 1  
110 of the furnace at some distance from and above the perforated bottom plate 5.

From a point above and in the vicinity of the bottom plate 5 a conduit or channel 7 extends  
115 from the fluidized bed 2 to a separate heat exchanger 8 arranged externally to the furnace itself. In the conduit 7 heated sand may flow from the fluidized bed 2 to the associated part of the heat exchanger 7. The heat exchanger comprises a cooler portion comprising e.g. a suitable cooling tube arrangement, and a schematically shown  
120 inlet with a pump 9 for cooling medium, and further an outlet 10 for the cooling medium.

The conduit 7 may be oblique, inclined towards  
125 the heat exchanger, so that the discharged sand flows towards the heat exchanger as a result of its weight.

As shown, the conduit 7 is provided with a valve 11 which is e.g. controlled by means of a

thermostat (not shown) and may control the sand quantity supplied to the heat exchanger 8. The sensor of the thermostat may e.g. sense the temperature existing in the fluidized bed, and the valve may be so arranged that it opens when the temperature increases.

After having given off a part of its heat quantity in the heat exchanger 8, the sand is conveyed therefrom by way of a transfer conduit 12 and supplied to the combustion chamber 1 through a suitable sand distributor 13 at the upper portion of the chamber, whereby the cooled sand cools the discharging waste gases and is again fluidized.

The cooled sand may alternatively or partly be returned directly to the fluidized bed to cool this.

The exhaust or waste gases are conducted away from the combustion chamber through an outlet 14 which may e.g. lead to a boiler (not shown). Possible secondary air for the combustion is supplied through supply means suggested schematically at 15.

In Fig. 2 there is shown an alternative arrangement of the apparatus according to the invention wherein a heat exchanger 16 is arranged in a lower part of the fluidized bed 2 in the reactor or combustion chamber 1, and a tapping means 17 is arranged below the heat exchanger, so that fluidized-bed medium which is tapped from the reactor, passes the heat exchanger on its way to the tapping means. In this embodiment the fluidized-bed medium is thus tapped in cooled condition, whereas in the embodiment according to Fig. 1, it is tapped in hot condition. The heat exchanger may consist of a suitable tube arrangement, or e.g. of a plurality of vertically disposed, plate-shaped cooler elements.

The fluidizing air is supplied through one or more supply tubes 19 which are connected to upwards perforated fluidizing tubes 20 suitably distributed in the fluidized bed 2. Thus, in this case the fluidized bed comprises a fluidized zone above the fluidizing tubes 20, in which zone also the combustion of the supplied fuel takes place, and a lower non-fluidized zone below the fluidizing tubes in the region of the heat exchanger 16.

By tapping of fluidized-bed medium (sand) through the tapping means 17, sand is removed from the region around the heat exchanger, and the tapped-out sand quantity is compensated by sand falling down between the fluidizing tubes 20. The hot sand sweeps along the surfaces of the heat exchanger elements 18 before it arrives at the tapping means 17, and is then relatively cold. The transport of sand back to the combustion chamber 1 takes place through a transfer conduit 12, in a manner corresponding to that of the embodiment according to Fig. 1.

It will be seen that the operation of the apparatus according to Fig. 2 is in the fundamental principle the same as that of the embodiment according to Fig. 1, and corresponding members are designated by the same reference numerals. A repeated description

of these members is therefore unnecessary.

## 65 CLAIMS

1. A method of operating a fluidized-bed incinerator having a combustion chamber containing a fluidized-bed medium which is heated during combustion of fuel in the combustion chamber, characterized in that a portion of the fluidized-bed medium is caused to pass a heat exchanger during tapping from the combustion chamber, and after cooling in the heat exchanger is returned to the fluidized bed of the combustion chamber.

2. A method according to claim 1, characterized in that the cooled medium is returned to the combustion chamber in an upper portion thereof and is allowed to fall down during cooling of the zone above the fluidized bed at the same time as the medium is heated by waste gases from the combustion.

3. A method according to claim 1 or 2, characterized in that the tapping is controlled by a thermostat sensing the temperature existing in the fluidized bed.

4. Apparatus for the operation of a fluidized-bed incinerator in accordance with the method according to claim 1, wherein the fluidized-bed incinerator comprises a combustion chamber with a fluidized-bed medium contained therein, characterized in that it comprises a means (7; 17) for tapping of fluidized-bed medium from the combustion chamber (1), a heat exchanger (8; 16) arranged to be supplied with fluidized bed medium during tapping from the combustion chamber, and a means (12; 17, 12) for transferring medium from the heat exchanger (8; 16) to the combustion chamber (1).

5. Apparatus according to claim 4, characterized in that the heat exchanger (8) is arranged outside the combustion chamber (1) and is connected to the fluidized bed of the combustion chamber through a channel (7) for transferring fluidized-bed medium from the fluidized bed (2) to the heat exchanger (8).

6. Apparatus according to claim 4, characterized in that the heat exchanger (16) is arranged in a lower portion of the fluidized bed (2) and the tapping means (17) is arranged below the heat exchanger, so that fluidized-bed medium which is tapped out, passes the heat exchanger elements (18).

7. Apparatus according to any of the claims 4—6, characterized in that the means (12, 13) for transferring medium which has been cooled in the heat exchanger (8; 16), debouches in an upper portion of the combustion chamber (1).

8. Apparatus according to any of the claims 4—7, characterized in that the tapping means (7; 17) comprises a valve (11) which is arranged to be controlled by a thermostat sensing the temperature existing in the fluidized bed (2).

9. A method of operating a fluidized-bed incinerator having a combustion chamber

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containing a fluidised-bed medium which is heated during combustion of fuel in the combustion chamber substantially as hereinbefore described.

5 10. An apparatus for the operation of a fluidised-bed incinerator substantially as hereinbefore described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1980. Published by the Patent Office,  
25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.